GROWTH AND YIELD OF PINK SHRIMP (Penaeus duorarum BURKENROAD) IN A FEEDING EXPERIMENT IN PONDS[1]

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ABSTRACT

A feeding experiment was conducted with pink shrimp (Penaeus duorarum Burkenroad) in ponds at Turkey Point in southeast Florida during May-October 1972. Postlarval shrimp were stocked at two densities (75,000 and 150,000 per ha), and two foods (wheat bran and Central Soya Master Mix Catfish Developer 934) were tested. Two feeding levels (averaging 19 kg/ha/day and 12 kg/ha/day) were tested with wheat bran, but the catfish food was fed only at the higher level.

Best shrimp growth was achieved at the lower stocking density with both foods. Shrimp stocked at 75,000 her ha and fed catfish food grew the fastest and attained an average weight (heads-on) near 8 g in 92 days. Only these were allowed to grow for another 64 days and reached an average weight of 12.5 g with 50% survival (from stocking). Survival ranged from 75-94% in shrimp harvested 90-92 days after stocking. With wheat bran, the largest average size attained in 92 days was near 6 g.

Best yields of shrimp (heads-on) were obtained at the higher stocking density with both foods. The highest yield, 555 kg/ha, after 90 days was achieved with catfish food and at a stocking density of 150,000 per ha. Shrimp stocked at 75,000 per ha and grown on catfish food for 156 days yielded 472 kg/ha. The highest

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yield obtained in 91 days with wheat bran as food was 402 kg/ha.

With wheat bran as food, better growth and better yield were obtained at the higher feeding level (averaging 19 kg/ha/day) than at the lower (averaging 12 kg/ha/day). Catfish food was fed only at the higher level.

INTRODUCTION

Caillouet et al., (1973) conducted feeding experiments in which wheat bran was used as an artificial detritus food for pink shrimp, Penaeus duorarum Burkenroad. The use of wheat bran showed from postlarval to marketable sizes.

The purpose of this investigation was to compare wheat bran and a commercial catfish food (Table 1) as foods for pink shrimp stocked at two densities (75,000 and 150,000 per ha) in ponds.

MATERIALS AND METHODS

Tabb et al. (1969) and Caillouet et al. (1973) gave detailed descriptions of the ponds used for shrimp culture research at Turkey Point in southeast Florida (Figure 1). Surface areas of the bottoms of the six ponds used in our experiment are approximately 0.08 ha (ponds 1 through 4) and 0.16 ha (ponds 5 and 6). Because the ponds are above sea level, bottoms are sealed with oolitic marl to retard water loss by seepage.

Ponds were filled to a depth of 1.5 m. Water, pumped from Loch Rosetta or from the turning basin (Figure 1) extending from nearby Biscayne Bay, was filtered through bags made of 345-u (bar measure) polyethylene mesh before it was introduced into the ponds. Ponds were filled over a 3-day period beginning 18 March, 1972. Beginning on 25 May and at 2-week intervals thereafter, water lost from ponds through evaporation and seepage was replaced with water from the turning basin or Loch Rosetta. On six occasions prior to stocking and once thereafter, fertilizer (Table 2) was added to each pond to stimulate algal blooms. Ponds were stocked on 25 May with 25-day-old pink shrimp postlarvae averaging 0.01 g.

With few exceptions, daily observations of dissolved oxygen (86 observations) and water temperature (85 observations) were taken as described by Caillouet et al. (1973), near the bottom of each pond, between 0800 and 1000 Eastern Standard Time, from the time ponds were stocked until they were drained to harvest the shrimp. Salinity was recorded at some time during the day on 26 days during the experiment.

The food type, stocking density, and feeding level pattern are outlined in Table 3 for ponds 1-6. About the same amount (averaging[4] 19 kg/ha/day) of food but less than ponds 1-4,

[4] The feeding level was not actually constant but was increased during the experiment (see Table 3).

during the first 90-92days after stocking. Ponds 1 and 3 received catfish food only at the higher level whereas wheat bran was added to two ponds (2 and 4) at the higher level and to two ponds (5 and 6) at the lower level. Shrimp in pond 3 continued to receive catfish food at the higher level until 28 October, whereas shrimp were harvested from all the other ponds in August, 90-92 days after stocking. Additional daily observations of dissolved oxygen, temperature and salinity were made in pond 3 until 28 October.

Beginning 13 June, samples of shrimp were removed from each pond at weekly intervals, and the shrimp were weighed (heads-on; see Caillouet et al., 1973) to measure growth (Figure 2). On each sampling day prior to 25 July, the number of shrimp weighed was 25 per pond. On 25 July and thereafter, 50 shrimp constituted the sample from each pond, except on the day when shrimp were harvested. The final sample of shrimp weighed per pond to determine growth was 100. After weighing, the shrimp that remained alive were returned to the ponds. No adjustments were made in the yield data to account for those that died after weighing, but the proportion (of those stocked) lost from each pond at each weighing was maintained at the same level (by removing some live shrimp) for all ponds (Caillouet et al., 1973).

All ponds were drained and flushed at night (Caillouet et al., 1973) to harvest shrimp (Table 3). Any shrimp remaining in a pond on the day following harvest were added to the total count and yield of shrimp (heads-on) in weight for that pond. Because the growth rate of shrimp in pond 3 exceeded that for the other ponds (Figure 2), shrimp were not harvested from this pond until 28 October.

Day to day change was the dominant source of variation in salinity, temperature and dissolved oxygen, so daily observations for the six ponds were averaged, and the averages are plotted in Figure 3. Salinity, temperature and dissolved oxygen observations taken from pond 3 after the other five ponds were harvested are also shown in Figure 3.

RESULTS

During the first 90 days or so after stocking, shrimp stocked at 75,000 per ha exhibited better growth than those stocked at 150,000 per ha, regardless of the type of food used. In ponds to which wheat bran was added, shrimp growth was slightly better at the higher feeding level (ponds 2 and 4) than at the lower feeding level (ponds 5 and 6). Such a comparison was not possible between the two ponds (1 and 3) to which catfish food was added, since the higher feeding level was used in both cases. At comparable stocking densities, shrimp grew more rapidly with catfish food than with wheat bran added to ponds, but survival was better with wheat bran. Growth of shrimp stocked at 75,000 per ha in ponds (2 and 5) to which wheat bran was added was about the same as growth of shrimp stocked at 150,000 per ha in a pond (1) to which catfish food was added.

The highest yields of shrimp (heads-on) were obtained at the highest stocking density (Table 3), regardless of the type of food used. In ponds to which wheat bran was added, higher yields were obtained at the higher level at comparable stocking densities.

The best shrimp growth and second best yield, 470.8 kg/ha, were obtained in pond 3 (stocked at 75,000 per ha). Survival of shrimp in pond 3 was estimated at 50%. Some of the mortality in pond 3 can be attributed to low oxygen, 0.3 PPM, which was detected in early morning on 30 June. We found a large number (27% of those stocked) of dead shrimp at this time, and feeding was discontinued until July 5 when the oxygen level returned to normal. During the interim, water was pumped into pond 3 continuously, and the excess was allowed to flow out the stack (Figure 1). The best yield, 555.2 kg/ha, was obtained with catfish food in pond 1 stocked at 150,000 per ha. Survival in ponds other than pond 3 ranged from 77-94%.

DISCUSSION

As pointed out by Caillouet et al. (1973), a large increase in stocking density usually results in a decrease in growth rate and an increase in yield of pink shrimp, and this is borne out in our results. Feeding of catfish food, apparently a better diet than wheat bran detritus for pink shrimp, offset this stocking density effect to some extent, since shrimp stocked at 75,000 per ha in ponds receiving wheat bran grew about the same rate as those stocked at 150,000 in the pond receiving catfish food. The two different levels of feeding wheat bran in this experiment elicited only a slight difference in growth rate of shrimp, with the higher level producing the faster growth. The higher feeding level in this experiment averaged about 19 kg/ha/day, considerably less than the 35 kg/ha/day suggested by Caillouet et al. (1973) to be a "safe" level for wheat bran. The lower level was used in our experiment because catfish food fed at higher levels might have caused oxygen depletion in the ponds.

Caillouet et al. (1973) conducted a similar experiment in ponds stocked with pink shrimp postlarvae (averaging 0.01 g) at two densities, 48,000 and 93,000 per ha. The shrimp were stocked on 18 May and harvested on 25 August, 1971. Wheat bran was added to the ponds at the rate of 15.8 kg/ha/day during 10-14 May, and at 34.6 kg/ha/day during 15-22 May (except on 4 days when oxygen level was low and no food was added). Growth and survival did not differ significantly at the two stocking densities. The shrimp averaged 4.2 g (heads-on) and survival was 86% 99 days after stocking. Yield of shrimp (heads-on) was 180 kg/ha at the lower stocking density and 318 kg/ha at the higher stocking density.

Our results fall in line with those of Caillouet et al. (1973). It appears that differences in yield of pink shrimp stocked at densities between 75,000 to 150,000 per ha were not great when wheat bran was added to ponds. However, the yield at the 48,000 per ha

stocking density, 180 kg/ha, was substantially less than those, 293.8-332.5 kg/ha, reported for the 75,000 per ha stocking density in our study. For a comparable period, catfish food fed at the same higher level we used for wheat bran produced a substantially higher yield, 555.2 kg/ha, than that obtained with wheat bran, 401.7 kg/ha, at the highest stocking density of 150,000 shrimp per ha. An additional 64 days of feeding of shrimp with catfish food in pond 3 more than doubled the average weight of these shrimp as compared to their weight at 92 days after stocking.

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